APPENDIX C

CRITERIA FOR SELECTION OF A CUT-OFF SCORE

Because the final Structural Score S can be directly related to the probability of major damage, the field survey building S scores can be employed in an approximate cost-benefit analysis of costs of detailed review versus benefits of increased seismic safety, as a guide for selection of a cut-off S appropriate for a particular jurisdiction.

As a preliminary guide to an appropriate cut-off value of S, note that an S of 1 indicates a probability of major damage of 1 in 10, given the occurrence of ground motions equivalent to the Effective Peak Acceleration (EPA) for the particular NEHRP Map Area. S =2 corresponds to a probability of 1 in 100, S =3 is 1 in 1000, and so on.

As a simple example, take a jurisdiction with a population of 10,000 and a corresponding building inventory of 3,000 wood frame houses and 100 tilt-up, 100 LR URM, and 10 mid-rise steel-framed buildings. Assume the jurisdiction is in NEHRP Map Area 6, and the Basic Structural Hazard scores of Appendix B, High seismic area, apply. Assume for the example that no penalties apply (in actuality, the penalties of course would discriminate the good structures from the bad). The building inventories, probabilities of major damage and corresponding mean number of buildings sustaining major damage are shown in Table C1.

Table C1

Type	No. Bldgs.	S	Prob. Major Damage	Expected No. Bldgs. With Major Damage
Wood	3,000	4.5	1/31,600	Approx. 0
Tilt-up	100	2.0	1/100	Approx. 1
URM	100	1.0	1/10	Approx. 10
Br. Steel Fr.	100	3.0	1/1000	Approx. 0

Given these results, this example jurisdiction might decide that a cut-off S of between 1 and 2 is appropriate. A jurisdiction ten times larger (i.e., 100,000 population, everything else in proportion) in the same Map Area might decide that the potential life loss in a steel-framed mid-rise (1,000 mid-rise buildings instead of 10) warrants the cut-off S being between 2 and 3. Different cut-off S values for different building or occupancy types might be warranted.

Ideally, each community should engage in some consideration of the costs and benefits of seismic safety, and decide what S is an appropriate "cut-off" for their situation. Because this is not always possible, the observation that research has indicated (NBS, 1980; see references in Appendix B) that:

> "In selecting the target reliability it was decided, after carefully examining the resulting reliability indices for the many design situations, that β = 3 is a

representative average value for many frequently used structural elements when they are subjected to gravity loading, while β = 2.5 and β = 1.75 are representative values for loads which include wind and earthquake, respectively".

(where β, the structural reliability index, as used in the National Bureau of Standards study, is approximately equivalent to S as used herein) is provided.

That is, present design practice is such that an S of about 3 is appropriate for day-to-day loadings, and a value of about 2 or somewhat less is appropriate for infrequent but possible earthquake loadings.

It is possible that communities may decide to assign a higher cut-off score for more important structures such as hospitals, fire and police stations and other buildings housing emergency services. However, social function has not been discussed in the development of the scoring system for this RSP. This will be addressed in a future FEMA publication tentatively entitled "Handbook for Establishing Priorities for Seismic Retrofit of Buildings." Until and unless a community considers the cost-benefit aspects of seismic safety for itself, a preliminary value to use in an RSP, would be an S of about 2.0.

APPENDIX D

ATC-21 PROJECT PARTICIPANTS

ATC MANAGEMENT

Mr. Christopher Rojahn (PI)
Applied Technology Council
3 Twin Dolphin Drive, Suite 275
Redwood City, CA 94065

Mr. Chris D. Poland (Co-PI)
Degenkolb Associates
350 Sansome Street, Suite 900
San Francisco, CA 94104

FEMA

Mr. Ugo Morelli (Project Officer)
Federal Emergency Management Agency
500 "C" Street, S.W., Room 625
Washington, DC 20472

SUBCONTRACTOR

Dr. Charles Scawthorn,
Consultant to Dames & Moore
EQE Engineering, Inc., 595 Market St.
San Francisco, CA 94105

PROJECT ENGINEERING PANEL

Mr. Christopher Arnold
Building Systems Development Inc.
3130 La Selva, Suite 308
San Mateo, CA 94403

Mr. Maurice R. Harlan
Lindbergh & Associates
7515 Northside Drive, Auite 204
Charleston, SC 29418

Mr. Fred Herman
City of Palo Alto
250 Hamilton Avenue
Palo Alto, CA 94303

Mr. William T. Holmes
Rutherford and Chekene
487 Bryant Street
San Francisco, CA 94107

Dr. H. S. Lew (FEMA Technical Monitor)
National Bureau of Standards
Center for Building Technology, Bldg. 226
Gaithersburg, MD 20899

Mr. Bruce C. Olsen
Consulting Engineer
1411 Fourth Avenue, Suite 1420
Seattle, WA 98101

Dr. Lawrence D. Reaveley
Reaveley Engineers & Associates
1515 South 1100 East
Salt Lake City, UT 84105

Ms. Claire B. Rubin
Natural Disaster Resource Referral Service
1751 B. South Hayes
Arlington, VA 22202

Dr. Howard Simpson
Simpson Gumpertz & Heger, Inc.
297 Broadway
Arlington, MA 02174

Mr. Ted Winstead
Allen and Hoshall
2430 Poplar Avenue
Memphis, TN 38112

Mr. Domenic A. Zigant
Naval Facilities Engineering Command
P.O. Box 727
San Bruno, CA 94066